

REMARKS/ARGUMENTS

Claims 7-10 and 14-18 are pending.

Claims 1-6 and 11-13 have been cancelled.

The front page of the Official Action (OA) does not indicate the status of the OA. The Examiner confirmed that the Official Action is not final in a telephone discussion of February 2, 2010.

Claims 7-10 and 14-18 are rejected under 35 U.S.C. 103(a) over JP 11-180902 (JP '902), Friedrich, US 3,669,877, Miller et al., US 4,340,465, and Suzukawa et al., US 3,551,513.

The rejection is traversed because

(a) the combination of the references does not describe or suggest a catalyst to hydrocarbon mass ratio of 18 to 40 (claim 1);

(b) the claimed method provides an advantageous result; and

(c) fluidized bed and catalyst bed technologies are not functionally equivalent.

(a) The Examiner has relied on Miller et al. for a catalyst to hydrocarbon mass ratio.

The Examiner is of the opinion that the Miller catalyst to hydrocarbon weight ratio is equivalent to the claimed catalyst to hydrocarbon mass ratio.

However, Miller et al. explicitly describe using the cracking conditions when the catalyst to hydrocarbon weight ratio is 2-15, which is outside of the claimed range (18-40). It appears that the Examiner has overlooked the amendment submitted on March 30, 2009. Alternatively, the Examiner has not explained why a skilled artisan would have modified the ratio of Miller et al. to be outside of the explicitly suggested ratio of 2-15.

JP '902 also explicitly describes in Example 1 that the catalyst hydrocarbon (butane) mass ratio is 3,443 calculated as follows (see the response filed November 13, 2009):

In JP '902, normal butane as a raw material is described as a raw material that is used in a rate of 2.8 cc/min per 1 gram of catalyst. In other terms, the butane gas is supplied at a rate of 1.21×10^{-4} g/sec which is calculated as follows:

$$1.21 \times 10^{-4} \text{ (g/sec)} = 2.8 \text{ (ml/min)} / 22414 \text{ (ml/mol)} \times 58.12 \text{ (g/mol)} / 60 \text{ (sec/min)}$$

On the other hand, the contact time of hydrocarbon with the catalyst is calculated as 2.4 sec as shown below, in view of the consideration that the specific gravity of a zeolite catalyst is about 0.6, where the supply rates of butane, nitrogen and steam are calculated from the volume flow at a reaction temperature of 650° C, i.e.:

$$2.4 \text{ (sec)} = 1 \text{ g} / 0.6 \text{ (g/ml)} / (\text{supply rates of butane, nitrogen and steam in ml/sec}) =$$

$$1 \text{ (g)} / 0.6 \text{ (g/ml)} / (0.158 + 0.321 + 0.207 \text{ (ml/sec)}).$$

Thus, the catalyst to hydrocarbon (butane) mass ratio of Example 1 of the '902 document is 3,443 as calculated as follows:

$$3443 = 1 \text{ (g)} / (1.21 \times 10^{-4} \text{ (g/sec)} \times 2.4 \text{ (sec)})$$

This value is outside the range of 18 to 40 for the catalyst to hydrocarbon mass ratio.

Thus, Miller et al. and JP '902 explicitly suggest using the catalyst to hydrocarbon mass ratio which is outside of the claimed range.

Moreover, substituting the catalyst to hydrocarbon ratio of Miller et al. (2-15) in the process of JP '902 that uses a completely different catalyst to hydrocarbon ratio of 3443 still does not provide the claimed method.

In addition, a skilled artisan would not have been motivated to modify the explicitly suggested catalyst to hydrocarbon ratio of 3443 of JP '902 with the low ratio of Miller et al. (2-15) with a reasonable expectation of still suppressing the formation of by-products at a low temperature and maintaining efficiency of the process of JP '902 (a goal of JP '902; see Abstract of JP '902) because JP '902 achieves its goal by using a completely different ratio.

(b) The claimed method provides an advantageous result as shown in the Examples of the present specification. For example, in Comparative Example 2, the catalyst to hydrocarbon mass ratio is 12, while in Example 1, the catalyst to hydrocarbon mass ratio is 20. As can be seen from the tables in the specification, Comparative Example 2 does not provide satisfactory reaction results as compared to that of Example 1. Table A below reproduces the data from Tables 1 and 2 on pages 10 and 11 of the present specification.

Table A

Example No.	Example 1	Comparative Example 2
Catalyst Rare earth element/Al (atomic ratio)	1.1	1.1
Reaction Conditions		
Reaction temperature (°C)	630	630
Catalyst/HC (mass ratio)	20	12
Steam/HC (mass ratio)	0.5	0.5
Contacting time (sec.)	1.0	1.0
Product Composition (mass % based on naphtha feed)		
Ethylene	25.8	15.4
Propylene	19.7	11.6
Butenes	6.7	4.2
Aromatic compounds	4.1	3.5
Methane	8.0	6.2
Ethane	8.8	5.5
Propane	8.5	5.8
Butane	2.7	2.3
C5 fraction	10.5	39.7
Coke	4.2	4.0
Carbon monoxide	0.6	0.2
Carbon dioxide	0.5	0.2

Thus, the claimed method provides an advantageous result which would not have been reasonably expected based on the disclosure of the cited references.

(c) Applicants submitted a complete and signed Declaration of Kenichi Wakui on January 25, 2010. It appears that the Examiner did not have the signed Declaration before her at the time of preparing the Official Action of January 27, 2010.

1. The signed submitted Declaration submitted on January 25, 2010, identifies the Declarant in 1), 2), and 3).

2. Item 5) is identified.

3. A certified statement that the submitted English translation of the book identified in 5) of the Declaration has been submitted with this response.

Applicants believe that the Declaration of Kenichi Wakui is complete and request that the Examiner consider the Declaration.

When referring to the translation of sections of the book previously submitted and as now formally presented of record in the Rule 132 declaration, a fluidized catalyst bed is different from a fixed catalyst bed. Accordingly, a considerable degree of study into process conditions, e.g., the catalyst/hydrocarbon ratio, because it is difficult to manipulate a fluidized bed.

More specifically, Applicants retain their comments previously advanced on the record with respect to the cited '902 reference. The reference, in fact, describes a method of catalytically cracking hydrocarbon feed materials over a catalyst of a rare earth element supported on a zeolite. The objective is to prepare light olefins such as ethylene and propylene by a cracking reaction which achieves high selectivity to the light olefin materials. A preferred catalyst support is either ZSM-5 or ZSM-11. The reference in paragraph [0009] discloses that the reactor employed may contain a fixed bed or fluidized bed catalyst material. The reference therefore clearly teaches an equivalency between the two types of catalyst systems. However, the '902 reference provides no teachings or description of operational details of any fluidized bed system. As applicants have previously stated, there are

disadvantages inherent to the use of fluidized bed systems, this despite the fact as discussed in the book previously discussed and now presented in more formal form in the Rule 132 declaration enclosed. Even with advancements in the fluidized catalyst bed-technology, despite the fact that many fluidized bed systems have been constructed, the current state-of-the-art of the equipment of such systems is that the operation and maintenance of the systems has to be done empirically, and that criteria for the design and operation of such systems have not been firmly established. In the invention many difficulties have been encountered with the fluidized bed system in order to fix operational conditions. Accordingly, when a fluidized bed system is used for a new chemical reaction, the best way of operating such a system is accomplished by trial and error. When a different chemical reaction is investigated, the operational control conditions will be quite different.

A skilled artisan would not have reasonably expected to suppress the formation of by-products at a low temperature and maintaining efficiency of the process of JP '902, and to prepare light olefins such as ethylene and propylene by a cracking reaction which achieves high selectivity to the light olefin materials (when using, e.g., the claimed conditions) in a fluidized bed-type reactor of Friedrich.

Thus, the cited references do not make the claimed method obvious. Applicants request that the rejection be withdrawn.

A Notice of Allowance for all pending claims is requested.

Respectfully submitted,

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